3

Treatment Manual

Nonchemical Treatments

Heat • Forced Hot Air

Contents

Forced Hot Air Treatment for Fruit

Pre-Treatment Procedures

The target pests of these treatments are fruit flies. An APHIS Inspector shall monitor all treatments done for quarantine purposes. Maintaining the dew point temperature of the chamber 2 ° C cooler than the temperature of the fruit surface avoids condensation on the fruit surface and improves fruit quality. However, for regulatory purposes, APHIS shall base the validity of treatment solely upon the center pulp temperature of the fruit. Control of blower speed and relative humidity in the chamber are the sole responsibility of the operator.

NOTICE

Any preconditioning treatments (such as degreening) shall not be conducted in the FHA chamber.

1 Forced hot air (FHA) is also referred to as high-temperature forced air (HTFA).

Sizing the Fruit

Fruits must be sorted by size before treatment. For some fruits, a size and weight limit has been established. After sizing, fruits that exceed the permitted size classes are not eligible for shipment. There is no minimum size requirement. The various sizes of fruits may be treated either *separately or together at the same time*, in their own respective trays or bins. For best results, however, only fruits similar in size and variety should be treated during the same run.

Placement of permanent temperature sensors (probes):

Placement of sensors (at least one per column) shall be monitored by an APHIS Inspector, and done in a certain, precise manner. Insert the sensors into the *center* of the *largest* fruits of the lot, at the *top* of the load of fruit located closest to air that exits the chamber. (Research has shown that these fruits, in this location, require the longest time to heat.) Be careful not to pinch the sensor cables.

In a FHA chamber that has *bottom air delivery*, place all sensors in large fruit in the *top layer* of trays or bins.

In a FHA chamber that has *top air delivery*, place all sensors in large fruits at the *bottom layer* of trays or bins.

In a FHA chamber that has *both bottom and top air delivery, side delivery*, or that has air delivery with a *reversible direction of flow*, place all sensors in large fruits in the *middle layers* of trays or bins.

Loading the fruit into the FHA chamber:

Under monitoring of the APHIS Inspector, bins or trays containing fruit shall be loaded directly over the delivery air source, leaving no uncovered space around the edges of the air supply ducts. The intention is to force the heated air through the slatted sides or bottoms of the bins or trays, not around them.

NOTICE

There is no minimum or maximum fruit pulp temperature required prior to beginning the treatment.

Procedures for Performing the FHA Treatment

Monitoring the temperature:

After the fruit has been loaded into the chamber, the door is closed, and the FHA generating equipment is turned on. The temperature recorder shall then begin making numerical recordings of temperatures from each sensor at least once every five (5) minutes, or make continuous pen-line recordings, color-coded for each sensor, on a graph paper readable in tenths of a degree (F or C). After the *warm-up period* [see below], the frequency of temperature recordings shall be increased to once every two (2) minutes.

The fruit pulp temperature (on all sensors) must be increased to the *target temperature* stated in the treatment schedule. This shall be done gradually, during a *warm-up period*. If the fruit are cool initially, the target temperature will require a longer approach time to achieve. The temperature of the delivery air should be slightly hotter than the target temperature. When all the fruits with sensors have reached their target temperature, and their minimum warm up time has been completed, the fruit center temperature (on all sensors) must then remain at or above treatment temperature for the amount of *dwell time* specified in the schedule. The APHIS Inspector shall review and approve the temperature records (by initialing them) when the entire treatment (warm-up period + dwell time) has been completed.

NOTICE

A faulty sensor, giving erroneous readings, does not necessarily negate a treatment. The suspected faulty sensor, after the load of fruit has been treated, must be tested by running a calibration check, to determine if it is accurate or faulty. If the sensor is found to be accurate, the treatment is negated. If the sensor is found to be faulty, the treatment is validated; however, this sensor must be replaced before the next treatment. In the case of repeated treatment failures, it may be necessary to change certain treatment parameters, then recertify the chamber. The same load of fruit may be retreated, at the option of the operator. However, APHIS assumes no liability for possible damage.

Control of air delivery temperature and blower speed:

The delivery air must be warmer than the target fruit pulp temperature, but this matter is left to the discretion of the operator. APHIS shall not require any particular temperature set point, because the treatment is based upon pulp temperature, not air delivery temperature. The operator is also given the flexibility to change the temperature of the delivery air at various times during treatment. Also, the delivery air temperature and/or blower speed may be varied according to the height (length) of the columns of fruit in the FHA chamber, based upon operator experience.

NOTICE

The APHIS Inspector monitoring the treatment may void (negate) a FHA treatment for failure of the operator to follow any treatment requirements.

Post-Treatment Procedures and Safeguards

Post-Treatment requirements

After treatment, the bins or trays of citrus must be moved immediately to a secured holding room or area (quarantine zone). After a 30-minute waiting period, the fruit may be cooled to enhance their quality (optional), and placed into commercial cartons. Other procedures, such as degreening and application of fungicides, are done at the option of the operator of the facility.

Each carton shall be stamped APHIS-USDA TREATED WITH FORCED HOT AIR, together with the APHIS stamp number assigned to the facility. Cartons must not be preprinted or prestamped with this information. Official rubber stamps shall be controlled by the APHIS Inspector.

Exporter compliance with prescribed safeguarding and safety measures:

The exporter shall be responsible for:

Providing adequate safeguards to prevent treated fruit from becoming exposed to the risk of reinfestation.

Performing each FHA treatment in a manner that conforms with APHIS requirements and sound safety procedures.

Maintaining the FHA chamber and packing house in a safe and sanitary condition at all times. This shall include providing industrial first-aid kits and approved safety equipment at the facility, and training in their use. He shall also ensure that local authorities and hospitals are aware of treatment activities, and are prepared to handle emergencies such as burns.

Designing an operator to be present throughout the entire treatment period (warm-up time + dwell time), who shall be trained and thoroughly familiar with treatment procedures and operation of the FHA chamber.

APPENDIX: EQUIPMENT AND MATERIALS PROVIDED BY THE EXPORTER

Forced hot air chamber:

Delivery of heated air is by means of high-speed blowers or fans, at a recommended air speed of 2 meters/second or higher. The air is forced to pass vertically or horizontally through the load of fruit being treated. It then passes out of the chamber through a heating system, and is returned to the chamber at the opposite end. The chamber must be constructed so as to accommodate the placement of several portable sensors during the yearly performance test. For this purpose, temporary access through an opening or openings in the chamber walls is required.

Trays or bins:

Fruit are to be treated in containers providing solid sides perpendicular to the direction of air flow, and vented or open sides in the direction of air flow, to facilitate movement of heated, moist air through the column(s) of fruit.

Permanent temperature sensors:

These may be high-performance RTD, thermistor, or thermocouple sensors (probes), installed at the ends of insulated wire cables long enough that all areas of the load can be reached. Fruit pulp sensors must be at least 2 inches in length. The operator of the facility shall maintain a supply of extra sensors to use as replacements.

The minimum number of sensors required shall be in proportion to the size of the load of fruit. In no case shall the number of permanent sensors be less than ten (10). However, each stack (column) of fruit must contain at least one fruit pulp sensor. For Example: A chamber with 5 stacks must have at least 10 sensors. A chamber with 20 stacks must have at least 20 sensors. It is recommended, however, that several extra sensors be installed.

In addition, it is recommended that additional sensors be installed to monitor supply air, return air, fruit surface temperature, and relative humidity. (For required placement of pulp sensors, refer to the earlier discussion.) Sensors shall be numbered, corresponding to a particular printout or pen line shown on the recorder. Accuracy must be to within plus or minus 0.5 ° F (0.3 °) of the true temperature.

Automatic temperature recorder:

This is a computerized device, which may be either a data logger or a continuous strip chart pen recorder. The combined accuracy of the entire temperature recording system must be to within plus or minus 0.5 ° F (0.3 ° C) of the true temperature, and the recording must be readable in whole degrees and tenths. This equipment is very sensitive, and must be kept inside an air-conditioned control room. An electrical surge protector is also recommended, to provide protection from voltage irregularities (power surges). For data loggers, one print shall be required for each sensor, at least once every five (5) minutes during warm-up, and every 2 (two) minutes during dwell time. The recorded model must be approved in advance by APHIS. Circular graph temperature recorders are not acceptable.

Portable temperature sensors:

These will be used by the APHIS Inspector during the yearly performance test. For every two permanent pulp sensors installed, at least one portable sensor must be available when needed for performance testing. As an option, additional permanent sensors may be used, if the automatic temperature recorder is capable of handling the additional capacity. Portable sensors can also serve as emergency back-ups in case of malfunctioning of permanent sensors.

For example: For a FHA chamber using 20 permanent pulp sensors, at least 10 portable sensors (or 10 additional permanent sensors) are required for the purpose of conducting the performance test for certification.

Portable temperature monitor:

This will be used by the APHIS Inspector during the yearly official performance test. It must be capable of reading in whole degrees and tenths. This instrument may be either a simple, hand-held thermistor devise that can be quickly connected to individual portable sensors in sequence, or it may be a more complex device that is capable of monitoring several sensors at once.

As a second option, in the absence of a portable temperature monitor, the chamber's permanent temperature recorder may be used during an official performance test, if it is capable of monitoring the minimum number of additional sensors required for the test (in addition to the normal number of permanent sensors).

As a third option, the APHIS Inspector may use cordless sensors during the yearly official performance test, if available. Readings from these sensors must be downloaded onto a computer after the treatment is completed.

The exporter shall not be required to purchase cordless sensors, because of high cost.

Certified thermometer:

A certified glass-mercury, water-immersible stick thermometer, readable in tenths of a degree, shall be kept on the premises at all times. This thermometer shall be certified by the factory to be accurate to within plus or minus 0.5 ° F (0.3 ° C) of the true temperature, and shall cover the range between 104 and 122 ° F (40 to 50 ° C). This thermometer shall be used as the standard against which all sensors are calibrated. It must be recalibrated by the manufacturer, or by an independent testing laboratory, at least once every five years.

Portable calibrator:

This is usually a small, swirling heated water bath, which provides a constant water temperature during the calibration of sensors.

Fruit sizing equipment:

This equipment shall be located in an area of the plant that is outside the quarantine zone, because sizing of fruit is required to be done *before treatment*.

Air curtain and/or double doors:

Air curtain generating apparatus (if used) shall be located on the wall or ceiling at the entrance to the quarantine zone, and shall blow air in an outward direction from the quarantine zone whenever the door is opened. A second option is to install a double door system (with a short walkway between the doors) at the entrance. Only one of the two doors may be open at a time.

Quarantine Zone:

Treated fruit must be brought to an insect-free encloser (usually a screened room), immediately after treatment. Packing line, palletizing, and banding equipment shall be located within this zone. A cooling system is optional. Fruit for markets other than the United States is not allowed to be present in the quarantine zone. Detection of live insects in the zone may be used as grounds for refusal to allow shipment of treated fruit that may be present. Untreated fruit is not allowed in this zone at any time.

Cooling equipment for treated fruit:

Thirty minutes after completion of FHA treatment, the fruit may be cooled. Forced air cooling may be done inside or outside the FHA chamber. Air temperature is optional. The fruit may also be brought to a refrigerated room within the quarantine zone. Cooling the fruit is not mandatory, but may be done to preserve fruit quality. It is not an integral part of the quarantine treatment.

Dry Heat Treatment Facilities for Niger (Guizotia abyssinica)

Introduction

Niger is grown as a marginal crop mainly in India, Ethiopia and Burma. Its black seeds are imported into the US for bird feed. Since niger is frequently contaminated with Federal Noxious Weed seeds, the seeds from any foreign place, at or before the time of arrival at the port of first arrival, are required to be heat treated in accordance with the applicable schedule of the PPQ's Treatment Manual.

Location of Treatment Facilities in the US

The proposed niger treatment facility should be constructed near the port environs; not exceeding 10 miles from the port.

Checklist of USDA-APHIS Minimum Requirements for Dry Heat Treatment Facilities for Niger Seed Treatment

Minimum Requirements for Dry Heat Treatment

- A minimum of two temperature probes must be situated in the heat treating equipment in such a way as to determine that all niger seed being treated reaches the target temperature.
- The temperature recording chart must show changes in temperature in increments of not less than 0.1 inch for each degree Fahrenheit (^{o}F) or 5 mm for each degree Celsius (^{o}C).
- Temperature readings must be recorded on the chart at time intervals not to exceed 4 minutes between each reading.
- Accuracy of the total temperature recording system must be within plus or minus 0.5 ^{o}F. (0.3 ^{o}C) of actual temperatures as recorded by a certified calibrated thermometer.
- A speed indicator must be present for continuous flow systems.
- All the valves and controls that affect heat flow to the treatment system must be secured to avoid manipulation by unauthorized personnel during the treatment process.
- Heating controls must be automatic and run continuously throughout the treatment process. Manual adjustments are allowed, if necessary.
- Gear systems used to control the niger seed conveyor (if applicable) must be capable of being adjusted as necessary to meet treatment requirements.
- An audible alarm or highly visible light must be installed on burners or other equipment to indicate system failure and/or when not operating properly.
- An action plan must be established to address any pests that may be associated with the storage, treatment, or shipment of niger seed.
- Proper sanitation measures must be implemented to ensure that there are no potential breeding grounds for pests on the premises, and therfore, little risk of reinfestation or cross-contamination.
- Treated seeds must be stored in a location separate from nontreated seeds. The treated and nontreated seeds must be handled in a manner to prevent cross-contamination.
- Seed processing equipment must have the capability to divert for retreatment any nontreated or treated seeds that do not meet treatment standards.

Requirements for a valid treatment

Facility Requirements

- Treatment must be in a niger seed facility maintaining current valid approval in good operating order so as to be capable of providing an acceptable treatment.
- The minimum number of temperature recording elements is two (2) fixed temperature probes. Accurate time/temperature records will also be maintained for any additional probes.
- Facility operators or managers must record the following information on each treatment chart:
  - date
  - lot number
  - Signature of operator

Treatment Requirements

The niger seed heat treatment schedule will be for at least 15 minutes at 120 ° C (248 ° F) and the following procedures will be used by operators to determine if treatment standards are met.

- Examine treatment records for completion of treatment
- Verify that the niger seed was kept at the target temperature for the required time.
- If for any reason records indicate that the niger seed was not held at the target temperature for the required time, the niger seed must be retreated and the reason for the faulty treatment corrected before any niger seed treatment may be continued.
- If any temperature reading falls below 120 ° C (248 ° F), the treatment for that specific lot of seed will be nullified and the seed will be retreated.

Documentation Requirements

- log book of all niger seed treatments
- records of equipment breakdowns and repairs and changes or modifications to the treatment process.

Sanitation and Pest Control

The Plant and Warehouse premises

The premises shall have a cleaning and control program. The facility manager will ensure that there are no potential breeding grounds for pests in the premises, and therefore little risk of re-infestation or cross contamination.

Containers and Packaging

The facility manager will ensure that packaging, whether used or new, shall be checked and cleaned for pests so that they are not a source of pests and contamination.

Waste Disposal

A regular waste program for waste, as well as nonconforming or infested produce will be implemented to ensure minimum risk of contamination and elimination of breeding sites of pests.

Post Treatment Requirements

- After treatment and cooling, the niger seed must be immediately placed in new bags. The old bags must be treated or disposed of in a manner that will eliminate regulated pests.
- PPQ will monitor (by sampling the treated seeds periodically) for actionable contaminants. Every 25th lot after treatment is to be sampled sometime in the middle of the bagging process. Random inspections and viability tests shall be performed, as needed by PPQ at the Port of Entry.

Each sample should be labeled with the following information:

- Origin of seed
- Vessel name and nationality
- Bill of lading number
- Container and lot number
- Date the seeds were treated
- Date the sample was taken

Laboratory results with the above information shall be sent to USDA-APHIS-PPQ-CPHST, Treatment Support & Certification, 1017 Main Campus Drive, Suite 2500, Raleigh, NC 27606.